

## Article

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### Revision of the loach species *Barbatula nuda* (Bleeker 1865) (Pisces: Balitoridae) from North China, with a description of a new species from Inner Mongolia

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#### Abstract

Variation in the currently recognized species, *Barbatula nuda* (Bleeker 1865), from North China was studied, and three distinct species are identified: *B. nuda*, *B. toni*, and *B. gibba* sp. nov.. The name *B. nuda* is presently misapplied; this species is distinct from *B. toni*, a species widely distributed in Northeast China, and occurs only in the Liao-He basin of Liaoning Province and the Tumen-Jiang basin of Jilin Province. The new species, *B. gibba*, is only found in Dali-Nur Lake in Inner Mongolia. Among Chinese *Barbatula* species, it is uniquely distinguished by the shape of the predorsal body.

**Key words:** taxonomy, *Barbatula nuda*, new species, North China

#### Introduction

*Barbatula* Linck 1790 is considered a valid nemacheiline genus from Europe and northern Asia (Kottelat & Freyhof 2007). However, the validity of this generic name is not entirely free from doubt. A few authors have argued that *Orthrias* Jordan & Fowler 1903 is a valid generic name for the species currently placed in *Barbatula* (Bănărescu & Nalbant 1995; Prokofiev 2007). Here, *Orthrias* is recognized as a junior synonym of *Barbatula*, following Kottelat's (1990) taxonomic treatment, which has been accepted by the majority of authors. To date, there are six valid species of *Barbatula* from northern Asia (Kottelat 2006; Prokofiev 2007): *B. altayensis* from the Kelang-He of the Ertix River in Xinjiang, North China; *B. compressirostris* (or *B. golubtsovi*) from the Khovd River basin in Mongolia and Tuva Republic of Russia; *B. dgebuadzei* from the lakes and rivers of the Gobi Lakes Valley in Mongolia; *B. potaninorum* from North China (possibly in Inner Mongolia); *B. sawadai* from the Selenga River basin in Mongolia and Russia; and *B. toni* from the Onon, Kherlen and Selenga basins in Mongolia, and all rivers which discharge into the Arctic and Pacific oceans between the Ob River and the Huang-He (=Yellow River in China).

*Barbatula* is currently represented in North China by three species: *B. altayensis*, *B. nuda*, and *B. potaninorum*. In Zhu's (1989) monograph of Chinese nemacheiline loaches, three species or subspecies were placed in this genus: *B. barbatula nuda*, *B. labiata*, and *B. microphthalmalma*. Subsequently, Zhu (1992) described *B. altayensis* from the Kelang-He of the Ertix River basin in Xinjiang, northern China. Wang *et al.* (2001) granted full species status to *B. barbatula nuda*. Prokofiev (2004) indicated that both *B. microphthalmalma* and *B. labiata* belong to *Triplophysa*. Later, Prokofiev (2007) described *Othrias potaninorum* (now *Barbatula potaninorum*) based on one specimen of 105 mm SL from Inner Mongolia, North China. Cao & Zhang (2008) showed that the species formerly reported as *B. labiata* is an undescribed species of *Triplophysa*, and named it as *T. waisihani*.

The currently identified species, *Barbatula nuda* (Bleeker 1865), is widely known from Xinjiang, Inner Mongolia, Heilongjiang Province, Liaoning Province, Jilin Province, and Hebei Province, North China (Zhu 1989; Wang *et al.* 2001; Xie 2007). Bleeker (1865) originally described it in *Nemacheilus* based on one specimen brought from China by Armand David (1826–1900). Its type locality was given in the original description as Mongolia, but without a precise location. Zhu (1989) placed this species in *Barbatula*, and treated it as subspecies of *B. barbatula*.

In recent years, Chinese authors (e.g., Zhu 1995; Wang *et al.* 2001) have used the name *B. nuda* for *B. toni* of earlier authors. This taxonomic treatment was questioned by Kottelat (2006), who held that *B. nuda* is likely a species distinct from *B. toni*, and that the materials recognized under the name *B. nuda* in today's Chinese literature represent several species of *Barbatula* or *Triplophysa*. An examination of the type specimen of *B. nuda*, and comparison with Chinese specimens currently identified under this name showed that three different species are involved: two formerly described species, i.e. *B. nuda* and *B. toni*, and one undescribed species. The aim of the present paper is to provide a revision of the currently recognized species, *B. nuda*, from North China.

## Material and methods

Measurements were taken point to point with digital calipers directly connected to a data recording computer and data recorded to the nearest 0.1 mm. Measurements and counts, made on the left side of individuals whenever possible, followed the methods of Kottelat (1990). Predorsal, prepectoral, prepelvic and preanal lengths were measured, respectively from the anteriormost tip of the snout to the dorsal-, pectoral-, pelvic- and anal-fin origins. Interorbital width was measured between the dorsomedial margins of eyes. Pectoral-pelvic distance was taken from pectoral-fin origin to pelvic-fin origin; pectoral-anal distance and pelvic-anal distance were measured the same way. The caudal-fin ray count is upper + lower branched rays. Anus-anal distance was taken from the anus to the anal-fin origin. Specimens were dissected to observe the gas bladder. Measurements of parts of the head are presented as proportions of head length. Head length and measurements of other parts of the body are presented as percentages of standard length. The counts of vertebrae, including the four Weberian vertebrae, were made from radiographs. The pores of the cephalic laterosensory canals and lateral line were traced with cyanin-blue (Saruwatari *et al.* 1997). The terminology of the cephalic laterosensory canals followed Kottelat (1984, 1990).

Specimens examined are stored in the collection of the Museum of Aquatic Organisms at the Institute of Hydrobiology, Chinese Academy of Sciences, Wuhan, Hubei Province, China (IHB), American Museum of Natural History (AMNH), Muséum National d'Histoire naturelle (MNHN), and Academia Sinica Institute of Zoology, Beijing, China (ZMFM or ASIZB). Abbreviations used are as follows: SL: standard length; HL: head length; D., P., V. and A.: abbreviations of dorsal-, pectoral-, pelvic- and anal-fin rays, respectively; CPD: caudal-peduncle depth

### *Barbatula nuda* (Bleeker 1865) (Fig. 1a)

*Nemacheilus nudus* Bleeker 1865:12 [Mongolia (but brought from China)].

? Xie in Liu & Qin 1987:187 (Qinyuan, Fushun, Benxi, Lingyuan, Jianchang, Chaoyang, and Jingzhou)

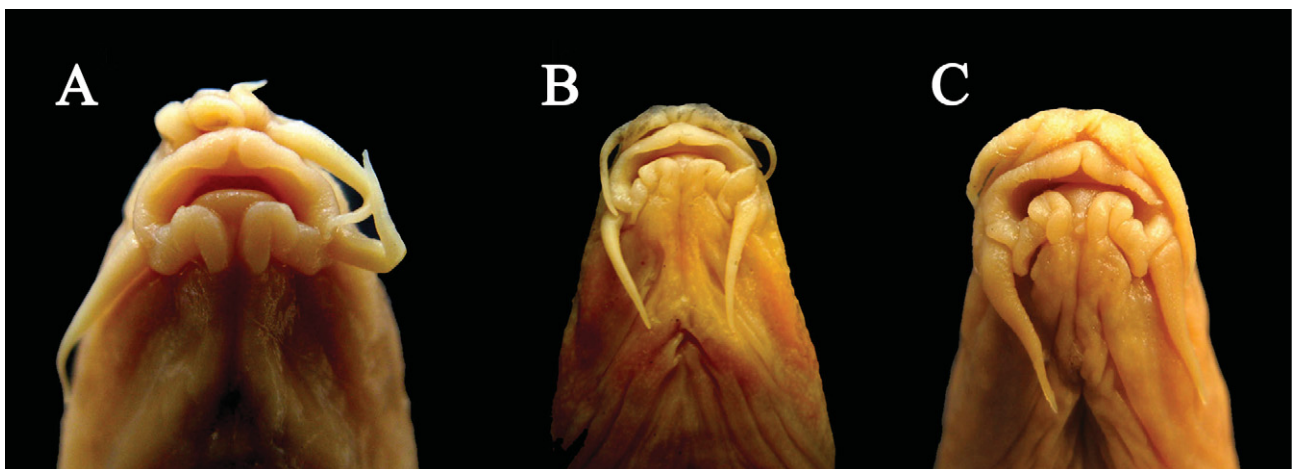
? *Barbatula barbatula nuda*: Xie 2007:236 (Qinyuan, Fushun, Benxi, Lingyuan, Jianchang, Chaoyang, and Jingzhou)

**Materials examined:** MNHN 0000–1450, holotype, 94.4 mm SL, Mongolia [brought from China], possibly in today's Inner Mongolia and Liaoning Province. IHB 77VII3477–9, 3 specimens, 72.7–79.4 mm SL, a tributary on west bank of Tumen-Jiang at Chongshan Town, Helong County of Jilin Province. IHB 88V0138, 88V0142, 88V0145–9, 88V0151, 88V0157–62, 16 specimens, 56.6–88.3 mm SL, Taizi-He, a tributary of Liao-He basin at Liaoyang City, Liaoning Province.

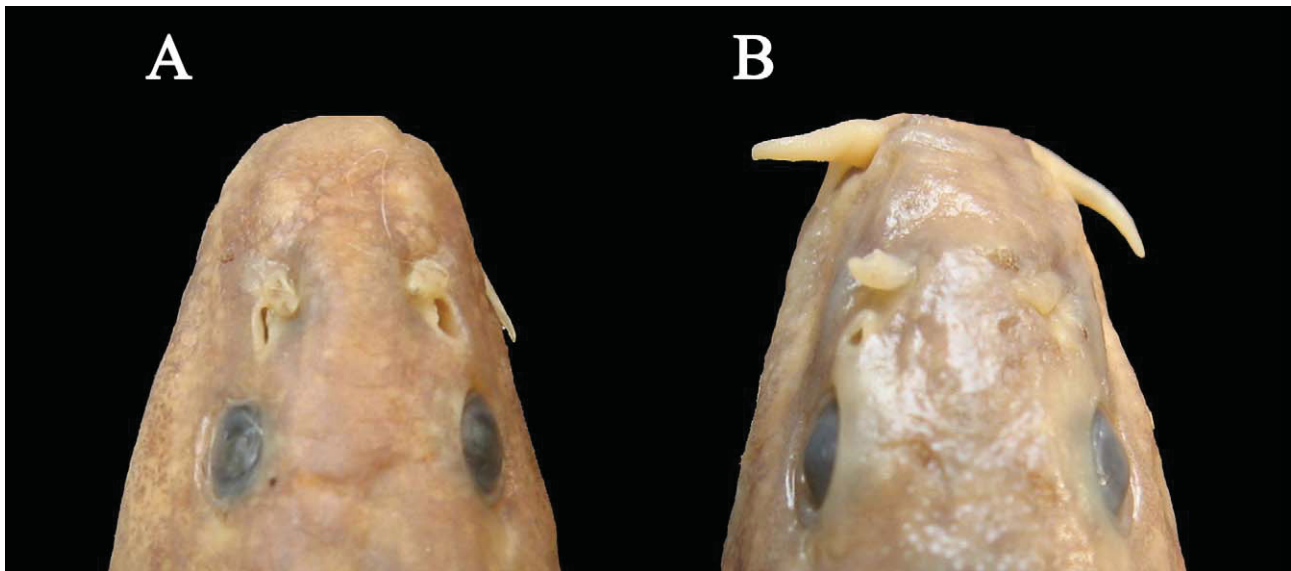
**Diagnosis.** *Barbatula nuda*, along with *B. dgebuadzei*, is distinguished from all other congeners from northern Asia by possessing an upper lip with a marked and deep (vs. slight and shallow) median indentation (Fig. 2a), and a nearly scaleless body or scales only on the caudal-fin base (vs. body scaled posterior to the dorsal-fin origin or a fully scaled body). It differs from *B. dgebuadzei* in having closely-set (vs. widely separated) nostrils (Fig. 3) and fewer vertebrae (40–42 vs. 43–45). *Barbatula nuda* is similar to both *B. altayensis* and *B. sawadai* in the shared presence of closely-set nostrils, a character distinguishing them from all other congeners from northern Asia with widely separated nostrils. It further differs from *B. altayensis* in having fewer vertebrae (40–42 vs. 44–45), and from *B. sawadai* in having fewer branched dorsal-fin rays (7 vs. 8). It resembles *B. compressirostris* (or *B. golubtsovi*) and *B. dgebuadzei* in scalation in that the body is scaleless or scales only on the caudal-fin base. *Barbatula nuda* is further distinguished from *B. compressirostris* (or *B. golubtsovi*) in having fewer vertebrae (40–42 vs. 45–47) and closely-set (vs. widely separated) nostrils.



**FIGURE 1.** Lateral views of: (A) *B. nuda*, IHB 77VII3478, 73.6 mm SL, China: Jilin Province: Tumen-Jiang basin at Helong County; (B) *B. toni*, IHB 20060802052, 83.1 mm SL, China: Liaoning Province: Daling-He at Yixian County; (C) *B. gibba*, IHB 76X2566, holotype, 70.7 mm SL, China: Inner Mongolia: Dali-Nur Lake in Hexigten Banner.



**FIGURE 2.** Ventral views of oromandibular structures of: (A) *B. nuda*, IHB 77VII3478, 73.6 mm SL, China: Jilin Province: Tumen-Jiang basin, Helong County; (B) *B. toni*, IHB 20060802052, 83.1 mm SL, China: Liaoning Province: Daling-He at Yixian County; (C) *B. gibba*, IHB 76X2566, holotype, 70.7 mm SL, China: Inner Mongolia: Dali-Nur Lake in Hexigten Banner.



**FIGURE 3.** Dorsal view of nostrils in: (A) *B. altayensis*, IHB 888001, holotype, 92.7 mm SL, China: Xinjiang: Kelang-He River of the Irtysh River basin: (B) *B. toni*, IHB761X9908, 70.6 mm SL, China: Inner Mongolia: Dali-Nur Lake in Hexigten Banner.

**Description.** Body elongate, anteriorly subcylindrical with its width slightly less than depth, and posteriorly compressed laterally; nearly scaleless body, if present, scales sparsely scattered on the caudal peduncle, and embedded beneath skin. Dorsal profile of head arched upwards at eye, dorsal profile of body straight, parallel with ventral profile. Ventral profile of head straight. Ventral body from pectoral-fin insertion to pelvic-fin insertion slightly convex; anal-fin base and postanal profile slightly concave. Caudal peduncle compressed, length less than HL and 1.8 to 2.2 times its depth; width 1.6 to 2.3 times in its depth.

Head depressed and trapezoid in dorsal view, wider than deep. Snout obtuse, shorter than postorbital head. Eyes small, close to dorsal profile of head. Interorbital space wide. Nostrils closely set together.

Mouth inferior, arched. Lips thick, smooth; upper lip with a marked and deep median indention and low lip without lateral expansions. Upper jaw covered by upper lip, without processus dentiformis, and lower jaw spoon-like, with its forepart exposed (Fig. 2a). Three pairs of barbels: two rostral and one maxillary; inner rostral barbels extending to corners of mouth; outer rostral ones reaching vertical of anterior margin of anterior nostril; maxillary ones extending to vertical through median to posterior margin of eye.

Lateral line complete, extending along middle of flank anterior to posterior end of anal-fin base, thereafter along middle of caudal peduncle. Supraorbital canal uninterrupted, not confluent with infraorbital canal; occipital canal continuous, confluent with infraorbital canal. Count of pores in cephalic sensory canal system: 7–8 in supraorbital canal, 12–14 in infraorbital, 3 in occipital, 8–10 in preoperculo-mandibular, and 70–76 in lateral line.

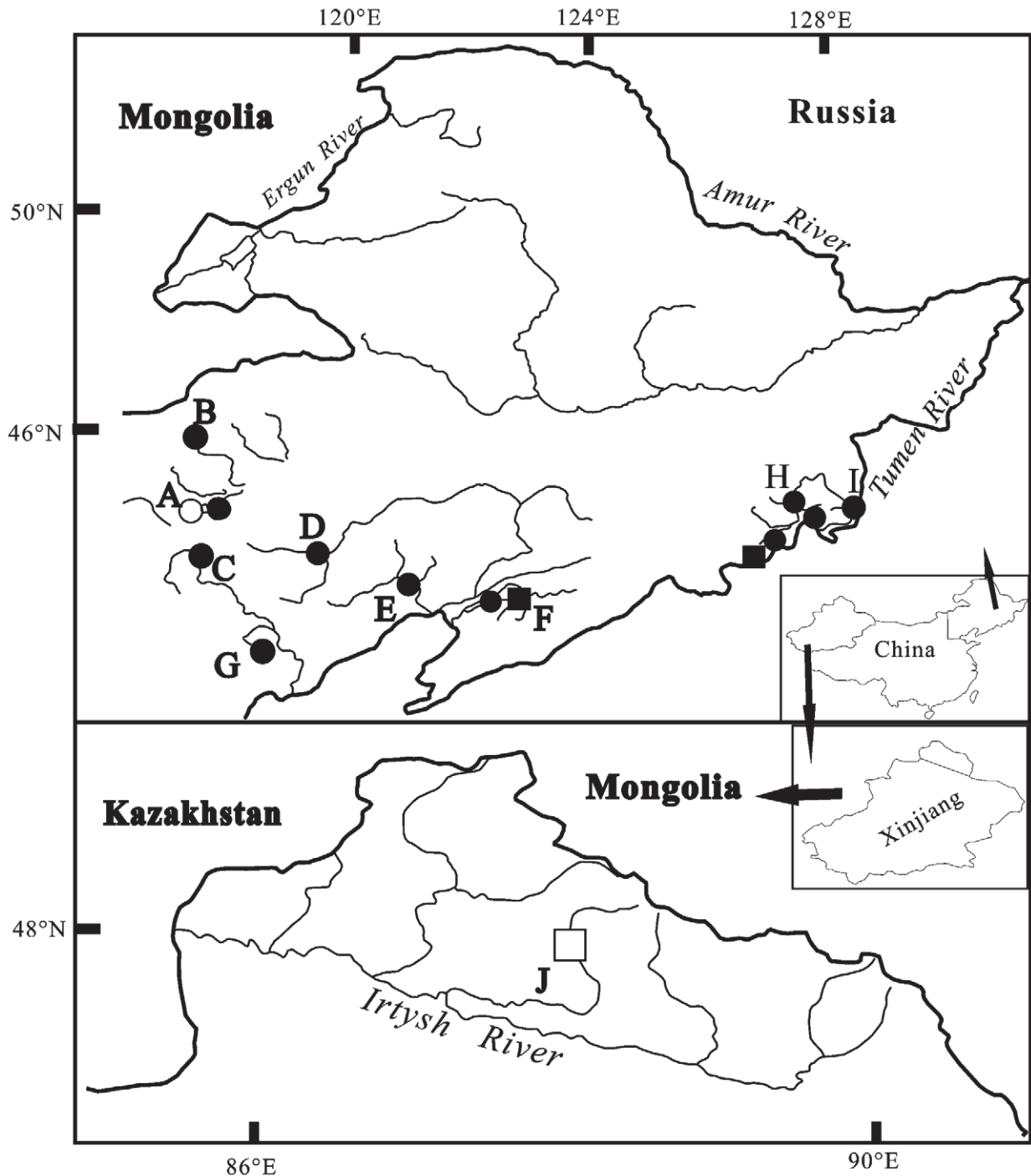
Fins flexible; D. iii, 7; P. i, 10–11; V. i, 6–7; A. iii, 5; C. 7–8+8 = 15–16 branched rays. Dorsal fin with a straight distal margin, origin nearer to caudal-fin base than to snout tip, last simple ray thickened near base. Pectoral fin inserted at vertical through posteriormost point of operculum, adpressed fin not reaching halfway to pelvic-fin base. Pelvic fin inserted vertical through dorsal-fin origin, adpressed fin not reaching anus. Caudal fin emarginate, its upper lobe as long as lower one. Vertebral count 40–42

Intestine forming a small coil, not touching U-shaped stomach. Gas bladder bipartite; anterior chamber fully enclosed in dumbbell-like capsule, and posterior chamber strongly reduced.

**Coloration in preservative.** Back and side of body brownish, and ventral body grayish. Six or seven transverse brown bars on predorsal region of body, and five to six on postdorsal region of body; bars wider than interspaces. Spots on pectoral, dorsal and caudal fins.

**Sexual dimorphism.** In specimens caught from May to July, males with broadened unbranched rays and 4–5 outer branched rays of pectoral fin; tubercles small, of uniform size, and sparsely scattered on dorsal surfaces of pectoral fins, both sides of head and body in males.





**FIGURE 4.** Map showing the distribution of Chinese species of *Barbatula*. (a) Dali-Nur Lake; (b) Xilin-He; (c) Shandian-He; (d): Laoha-He; (e) Daling-He; (f): Taizi-He; (g): Luan-He; (h): Gaya River; (i): Hunchun-He; (j): Kelang-He River. *Barbatula toni* (●); *B. nuda* (■); *B. gibba* (○); *B. altayensis* (□).

**Distribution.** Currently known from the Tumen-Jiang basin in Jilin Province, and the Taizi-He, a tributary of the Daling-He basin in Liaoning Province (Fig. 4).

**Remarks.** In Chinese literature, *B. nuda* and *B. toni* had been confused with each other until Kottelat (2006) clarified some taxonomic problems. We agree with Kottelat that *B. nuda* is a species distinct from *B. toni*. Our examination of the type material of *B. nuda* demonstrated that this species possesses closely-set nostrils, a nearly scaleless body (if present, scales are only on the caudal-fin base), and a straight dorsal profile of the body, by which it is distinguished from *B. toni* (see below for its diagnostic characters). Further comparison revealed that these

three characters are shared with the specimens from the Taizi-He of the Liao-He basin in Liaoning Province, and the Tumen-Jiang basin in Jilin Province. These materials are thus considered as conspecific with *B. nuda*. *Barbatula nuda* has a restricted distribution compared with that of *B. toni*, a species broadly distributed in Northeast China or northern Asia. Apparently, the identity of *B. nuda* in this study is different from that of all earlier authors.

The species recognized by Xie in Lin & Qin (1987) and Xie (2007) as *B. nuda* from Liaoning Province needs confirmation. In terms of his descriptions, this species possessed a scaleless anterior body, and a sparsely scaled posterior one. This scalation is similar to that of *B. nuda*, but its nostrils are widely separated, as in *B. toni*. Probably, Xie's specimens from the Xiaoling-He (in Jinzhou City), the Daling-He (in Jianchang County, and Lingyuan and Chaoyang cities), and the Liao-He (in Qingyuan, and Benxi counties and Fushun City) represent two distinct species here identified as *B. toni* and *B. nuda*. It is found in this study that these two species sympatrically occur in the Liao-He basin of Liaoning Province, and in the Tumen-Jiang basin of Jilin Province.

The type locality of *B. nuda* remains unclear. It was given in the original description as Mongolia (but brought from China). Kottelat (2006) pointed out that the present Mongolia is impossibly the type locality of *B. nuda* as Bleeker's (1865) original description was based on a single specimen brought from China by Armand David. On the basis of Luo (2003) and Kottelat (2006), David made extensive collections in China from 1862 to 1864. He visited the Siwantze (in today's Chongli County), 25 km northeast of Kalgan (today's Zhangjiakou City of Hebei Province) in 1862; the mountains bordering the west of the plain of Beijing in 1863; and Jehol (a previous Chinese province that comprises today's Chengde Prefecture of Hebei Province, Chaoyang and Fuxin prefectures of Liaoning Province, and Chifeng City of Inner Mongolia Autonomous Region) in 1864. Undoubtedly, the type locality of *B. nuda* should be within the above mentioned areas. The species recognized by Wang (1984) as *Nemacheilus toni* from Beijing, and by Wang *et al.* (2001) as *B. nuda* from Hebei Province, is *B. toni* based on their descriptions and an examination of the type material of *Barbatula toni fowleri* Nichols 1925 from the Luan-He basin in Hebei Province showed in this investigation to be identical to *B. toni* as here identified (see below). This means that the type locality of *B. nuda* is not in rivers draining Beijing, and Chengde and Zhangjiakou cities of Hebei Province. The Daling-He or Liao-He basin is possibly the type locality of this species as both together drain Chaoyang and Fuxin prefectures of Liaoning Province, and Chifeng City of Inner Mongolia, all of them being part of Jehol (a former Chinese province which David visited in 1864). The fixation of the precise type locality of *B. nuda* requires more samplings in the upper Liao-He basin and the Daling-He basin. This is because the distribution of *B. nuda* (in the Taizi-He of the Liao-He basin in Liaoning Province and the Tumen-Jiang basin in Jilin Province) lies outside the ranges explored by Armand David during 1862–1864.

### ***Barbatula toni*** (Dybowski 1869) (Fig. 1b)

*Cobitis toni* Dybowski 1869:957 (Onon River and Ingoda River basin)

*Nemachilus pechiliensis* Fowler 1899:181 (Tan Lan Ho, tributary of Shan Lan Ho, about 30 miles Northeast of Lama-miau or Dolon-nor, Pechili Province [Luan-He basin in Duolun, Inner Mongolia]).

*Barbatula toni fowleri* Nichols 1925:3 (Eastern Tombs, Chili, Hopeh Province); Shaw & Tchang 1931, 79 (Chung-tah-shien, near Tungling, Hopei Province); Tchang 1959, 123 (Hopei Province and Inner Mongolia);

*Barbatula toni*: Tchang 1933:207 (Mongolia, Northeast China, and Hopei Province); Tchang 1959: 121 (Inner Mongolia, Northeast China, and Peiping); Nichols 1943: 216 (Hebei Province)

*Barbatula toni kirinensis* Tchang 1932:115 (Ching-po Lake); Tchang 1933: 109 (Ching-po Lake); Tchang 1959:122 (Ching-po Lake, and Beijing)

*Barbatula toni toni*: Shaw & Tchang 1931:78 (Inner Mongolia); Nichols 1943: 216 (Hopei Province, and Northeast China);

*Nemachilus toni*: Zheng *et al.* 1980:69 (Tumen-Jiang, and Hunchun-He, Jinlin Province)

**Materials examined.** IHB 77VII2474–6, 77VII2480, 4 specimens, 71.4–91.8 mm SL, from Chongshan Town, on west bank of Tumen-Jiang in Jilin Province; IHB 890058–9, 890061–2, 890064–5, 89IX0290, 89IX0293, 89IX0295–8, 15 specimens, 94.9–121.9 mm SL, Hunchun-He of Tumen-Jiang basin in Chunhua Town, Hunchun County, Jilin Province; IHB 79VII0155, 79VII 0166, 79VII0169–70, 79VII0041, 79VII 0045–47, 8 specimens, 52.6–98.5 mm SL, Tumen-Jiang basin at Hunchun County, Jilin Province; IHB 89IX0536–40, 5 specimens, 75.5–103.1 mm SL, Gaya-He of Tumen-Jiang basin, at Wangqing County, Jilin

Province; IHB 76X2501 76X2505, 76X2509, 76X2523, 76IX9904, 76IX9906–8, 76IX9910, 76IX9912–4, 76IX9916, 76IX9930, 76IX9933, 76IX9963, 76IX9973, 76IX9999, 19 specimens, 57.3–104.1 mm SL, Dali-Nur Lake in Hexigten Banner, Inner Mongolia; IHB 88V0143, 88V0152–7, 6 specimens, 69.6–105.3 mm SL, from Taizi-He of Liao-He basin, at Liaoyang County in Liaoning Province; IHB 76IX9743–8, 76IX9751, 76IX9753–6, 76IX9766, 12 specimens, 47.2–71.0 mm SL, Xilin River basin in Inner Mongolia; IHB 20060801837–40, 20060801843, 20060802036 –8, 20060802041–9, 20060802051–2, 200608053–4, 22 specimens, 52.18–94.54 mm SL, Daling-He at Yixian County, Liaoning Province. IHB58VII0085–6, 58VII0180, 58VII0183, 4 specimens, 59.0–66.2 mm SL, Ergun River basin in inner Mongolia.

**Diagnosis.** *Barbatula toni*, along with *B. altayensis* and *B. sawadai*, is distinguished from all other congeners from northern Asia by having the body scaled predorsally (vs. body scaled posterior to the dorsal-fin origin, or scales only on the caudal-fin base). It differs from *B. altayensis* and *B. sawadai* in having widely separated (vs. closely-set) nostrils, and further from *B. altayensis* in having fewer vertebrae (42–43 vs. 44–45), and further from *B. sawadai* in having fewer branched dorsal-fin rays (7 vs. 8).

**Description.** Body elongate, compressed, and entirely scaled; scales small, embedded beneath skin. Dorsal profile of head slightly arched upwards, and dorsal profile of body slightly arched. Anal-fin base and postanal profile somewhat concave. Greatest body depth immediately anterior to dorsal-fin origin and least caudal-peduncle depth at vertical through posterior end of anal-fin base. Caudal peduncle laterally compressed, length less than HL, and 1.6 to 2.4 times its depth; width 1.6 to 2.3 times in its depth.

Head compressed in lateral view, roughly triangular in dorsal view, wider than deep. Snout blunt, equal to or longer than postorbital length of head, shorter than head height. Eye small, close to dorsal profile of head, with a wide, nearly flat interorbital space. Nostrils widely separated (Fig. 3b), with a gap nearly equal to distance between posterior nostril and anterior margin of eye.

Mouth inferior and arched. Lips thick, slightly papillated; upper lip with a small and shallow median indentation, and lower lip with marked lateral expansions. Upper jaw covered by upper lip or unexposed, without processus dentiformis; lower jaw spoon-like, anteriorly exposed and laterally covered by lower lip (Fig. 2b). Three pairs of barbels; two rostral pairs, inner ones extending to corner of mouth, and outer ones reaching vertical of anterior margin of posterior nostril, and one maxillary, extending to vertical through median to posterior margin of eye.

Lateral line complete, extending along midlateral body anterior to posterior end of anal-fin base, thereafter along middle of caudal peduncle. Supraorbital canal uninterrupted, not confluent with infraorbital canal; occipital canal continuous, confluent with infraorbital canal. Count of pores in cephalic sensory canal system: 7–8 in supraorbital canal, 12–14 in infraorbital, 3 in occipital, 8–10 in preoperculomandibular, and 70–79 in lateral line.

Fins flexible, D. iii, 7; P. i, 10–11; V. i, 6–7; A. iii, 5; C. 7–8+8 = 15–16 branched rays. Dorsal fin with a straight distal margin, origin nearer to caudal-fin base than to snout tip, last unbranched ray thickened near base. Pectoral fin inserted immediately vertical through posteriormost point of operculum, adpressed fin not reaching beyond halfway to pelvic-fin base. Pelvic fin inserted vertical through dorsal-fin origin, adpressed fin not reaching anus. Anal fin with a straight distal margin. Caudal fin truncate or slightly emarginated, its upper lobe as long as lower one. Vertebral count 42–43.

Intestine forming a zigzag loop anteriorly, not touching U-shaped stomach. Gas bladder bipartite; anterior chamber fully enclosed in dumbbell-like capsule and posterior chamber strongly reduced.

**Coloration in preservative.** Back and side of body brownish, ventral body grayish. Five or six transverse brown block bars on predorsal region of body, and four or five on postdorsal region. A bunch of variable-sized, irregular bars scattered along lateral line on flank. Spots also present on pectoral, dorsal and caudal fins.

**Sexual dimorphism.** Males with broadened unbranched rays and 4–5 outer branched rays of pectoral fin. Breeding tubercles present on dorsal surfaces of pectoral fins, each side of head and body in males.

**Distribution.** Presently known from the Dali-Nur Lake, the Xilin-He basin, and the Laoha-He (a tributary of the upper Liao-He basin) in Inner Mongolia, the Liao-He basin in Liaoning Province, and the Tumen-Jiang basin in Jilin province. This species is reportedly present in the Luan-He basin of Hebei Province and Beijing (Wang 1984; Wang *et al.* 2001) (Fig. 4).

**Remarks.** There are debates regarding the taxonomic status, type locality, and identity of *B. toni*. It was considered by Kottelat & Freyhof (2007) as a distinct species, but by Prokofiev (2003, 2007) as a subspecies of *B. barbatula*. Prokofiev (2003) commented that the type locality of *B. toni* was likely China, but Kottelat & Freyhof (2007) asserted that its type locality is the Onon and Ingoda rivers of the upper Amur River basin. As a result, there

are different opinions about the identity of *B. toni*. From Prokofiev's (2007) point of view, *B. toni* is a subspecies widely known from northern Asia, with which a number of nominal species are synonymized, and comprising several populations distinguishable from each other by statistical differences. In Kottelat's (2006) opinion, the currently identified *B. toni* includes many described species of *Barbatula*, and even some species of *Triplophysa*; the populations of the Onon and Ingoda rivers will retain the nominal name *B. toni*. Comparison of Prokofiev's figures (Figs. 9–14) of osteological characters for different populations indicates that many distinct species are involved. Therefore, Kottelat's taxonomic treatments of *B. toni* are followed in the present study.

Despite no access to the type and other materials of *B. toni* from its type locality (in the upper Amur River basin) in this study, information regarding the main diagnostic characters of this species is available in the literature. Specimens used for Prokofiev's (2003) pictures of *O. barbatula toni* (now *B. toni*) from the Onon River of the upper Amur River basin show that they have widely separated nostrils and a convex predorsal profile of the body. These two characters were also figured in the specimen in Kottelat's (2006) picture for *B. toni* from the Onon River of the upper Amur River basin in Inner Mongolia. Prokofiev's specimens, according to his description, usually possess reduced scales anterior to the dorsal-fin origin. Apparently, three characters typical for *B. toni* are: widely separated nostrils, a concave dorsal profile of the body, and a scaled predorsal area.

In China, *B. toni* (Dybowski 1869) has until now been regarded as a junior synonym of *B. nuda* (Bleeker 1865) (Zhu 1989, 1995). The main reason is that the type specimen of *B. nuda* is inaccessible to all former Chinese investigators so that they do not have a better understanding of its identity. Lack of examination of the type specimen of *B. nuda*, coupled with insufficient available information about *B. toni*, possibly led these investigators to conclude that both names applied to the same species. As a result, *Nemacheilus nudus* have been regarded as the available name as it has priority over *Cobitis toni*. An examination of the type material of *B. nuda* affirms Kottelat's (2006) conclusion that it is a species distinct from *B. toni*. *Barbatula nuda* differs from *B. toni* in having closely-set (vs. widely separated) nostrils, a nearly straight (vs. convex) predorsal profile of the body, and scales only on the caudal-fin base (vs. a scaled predorsal body). Further comparison showed that the materials currently recognized as *B. nuda* from the Taizi-He of the Liao-He basin in Liaoning Province, and the Tumen-Jiang basin in Jilin Province are conspecific with *B. nuda* s. str. The specimens of the lake Dali-Nur in Inner Mongolia, the Liao-He basin in Liaoning Province and Inner Mongolia, the Daling-He basin in Liaoning Province, and the Tumen-Jiang basin in Jilin Province possess a scaled predorsal region and widely separated nostrils, based on which they are probably identical to *B. toni*. However, they have a relatively shorter head, and more anteriorly situated dorsal and pelvic fins, suggesting it might be a species distinct from the species illustrated by Prokofiev (2003) as *B. toni* from the type locality (upper Amur basin). The body coloration also disagrees with Kottelat's (2006) picture of *B. toni*. Without access to the Amur River basin specimens, it is impossible to conclude here whether the materials here identified as *B. toni* from northern China represent a distinct species.

The species previously recognized by Anonymous (1979) as *B. toni* from the Ertix of the Ob River basin and Ulungur basins in Xinjiang, northern China is *B. altayensis*, a species originally described by Zhu (1992) from a tributary of the Ertix River at Altay, and the material of *B. nuda* figured in Kimura *et al.* (1992) from the Ertix River in Altay, is likely an unnamed species (Kottelat 2006).

Kessler (1876) described two loach species from the lake Dalai-Nor (= Hu Lun) in the upper Argun River basin of Inner Mongolia, northern China: *Diplophysa intermedia* and *D. nasalis*. Both were later considered by Zhu (1989) as synonyms of *B. nuda* (the name used in China for *B. toni*). However, Prokofiev (2001) revealed that *D. intermedia* is a species of *Triplophysa* based on his examination of the holotype. Prokofiev's (2004) examination on the holotype of *D. nasalis* also revealed that it shares a mixture of characters diagnostic for *Barbatula* and *Triplophysa*. Its generic classification remains to be determined owing to the poor condition of the type specimens. Whatever the ultimate generic placement, *D. nasalis*, according to Prokofiev (2004), differs from Chinese *Barbatula* species in having a scaleless (vs. scaled, except for *B. nuda*) body, interrupted (vs. uninterrupted) supraorbital canals, and occipital and infraorbital canals disconfluent (vs. confluent). *Barbatula nuda* further differs from this species in having closely-set (vs. widely separated) nostrils.

In addition to *Diplophysa nasalis* Kessler 1876, three species have been listed as synonyms of *B. nuda* (= *B. toni*) in the Chinese literature records: *Nemachilus pechiliensis* Fowler 1899, *Barbatula toni fowleri* Nichols 1925, and *Barbatula kirinensis* Tchang 1932. Their taxonomic status is reevaluated based on the examination of type materials and information in the literature.



*Barbatula pechiliensis* was originally described in *Nemachilus* (= *Nemacheilus*) by Fowler (1899) from the Tan Lan Ho, a tributary of the Shu Lan Ho (in the upper Luan-He basin), about 30 miles northeast of Lama-Miau or Dolon-Nor (in today's Inner Mongolia), Pechili Province, China. It has long been regarded as invalid by subsequent authors (Berg 1949; Zhu 1989; Kottelat 2006; Prokofiev 2007). The original description of this species indicated that the holotype (ANSP16394) was deposited in Academy of Natural Sciences of Philadelphia (ANSP). A recent search for the type specimen by ANSP staff of the ichthyology collection yielded no results (M. Sabaj-Perez, pers. comm.). Given that no specimens have been collected from the upper Luan-He basin in Dolon-Nor, Inner Mongolia, the type locality of *B. pechiliensis*, we tentatively follow earlier authors to consider it a synonym of *B. toni*.

*Barbatula toni fowleri* was initially described by Nichols (1925) from Eastern Tombs, Chili (today's Hebei) Province, in the Luan-He basin. The original description stated that it had closely-set nostrils and scales only evident on the (caudal) peduncle. Our photographic examination of the holotype indicated that it has widely separated nostrils, and a scaled body. The vertebral count made from an x-ray radiograph are  $39+4=43$ , which lies within the range of the counts we took for specimens here recognized as *B. toni* from North China. Based on these three characters, *B. toni fowleri* is here considered a synonym of *B. toni*.

*Barbatula kirinensis* was first described by Tchang (1932) from Kirin (Jilin Province), China. The original description of this species stated that the type material was stored in the Institute of Zoology, Chinese Academy of Sciences (ZMFM or ASIZB 7931). However, a recent search for the type by ASIZB staff of the ichthyology collection yielded no results (Y. H. Zhao, pers. comm.). The establishment of this species was based on the differences with its closely associated species *B. toni* in caudal-peduncle length, and body coloration. Our examination of the specimens from Tumen-Jiang Jilin Province showed that these two characters are variable among individuals and geographical populations of the same loach species. Thus, we tentatively follow earlier authors to consider it a synonym of *B. toni*.

### ***Barbatula gibba* sp. nov.**

(Fig. 1c)

**Holotype.** IHB 76X2566, 70.7 mm SL; Dali-Nur Lake in Hexigten Banner, Inner Mongolia.

**Paratypes.** IHB 76X2552–4, 76X2558–9, 76X2562, 76X 2564, 76X2567–8, 76X2574, 76X2576, 76X2584–5, 13 specimens, 46.7–75.7 mm SL, other data same as holotype.

**Diagnosis.** *Barbatula gibba* is distinguished from all other congeners from northern Asia by having a nearly columnar (vs. slightly compressed) anterior body, and a greatly convex (vs. slightly convex or straight) predorsal profile of the body. It is similar to *B. nuda* in having a scaleless predorsal body, by which both can be distinguished all other congeners from northern Asia, with sparsely, or fully scaled predorsal bodies. *Barbatula gibba* further differs from *B. nuda* in having widely separated (vs. closely-set) nostrils, and an upper lip with a slight and shallow (vs. marked and deep) median indentation.

**Description.** Body elongate, anteriorly nearly columnar with its width nearly equal to depth and posteriorly compressed laterally, scaled posterior to vertical through dorsal-fin origin; small scales sparsely scattered, and embedded beneath skin. Dorsal profile of head straight; predorsal profile of body greatly arched upward and declining rapidly along dorsal-fin base; and postdorsal body straight and slightly parallel with ventral. Ventral profiles of head and body from pectoral-fin insertion to anal-fin origin straight; anal-fin base and postanal profile slightly concave. Greatest body depth at vertical through midpoint between pectoral- and pelvic-fin insertion, and least depth of caudal peduncle at vertical through posterior end of anal-fin rays. Caudal peduncle laterally compressed, shorter than HL, and length of it 1.9 to 2.4 times its depth; width 1.5 to 2.3 times in its depth.

Head depressed and triangular in dorsal view, wider than deep. Snout obtuse, shorter than postorbital length of head and head height. Eyes small, close to dorsal profile of head. Nostrils widely separated by a gap twice distance between posterior nostril and anterior edge of eye.

Mouth inferior and arched. Lips thick; upper lip slightly papillated with an indistinct median incision and lower lip with small lateral expansions. Upper jaw unexposed or fully covered by upper lip, without processus dentiformis; lower jaw spoon-like with its anterior exposed, and laterally covered by lower lip (Fig. 2c). Three pairs of barbels, one maxillary, and two rostral; inner rostral barbels extending to corner of mouth, and outer rostral ones reaching to vertical of anterior edge of posterior nostril; maxillary ones extending to vertical through post half of eye.

**TABLE 1.** Morphometric data for three species *Barbatula toni*, *B. nuda*, and *B. gibba*.

Characters	<i>B. toni</i> (n = 91)	<i>B. nuda</i> (n = 17)	<i>B. gibba</i> sp. nov.	
			Holotype	Paratypes (n = 13)
				Range (Mean±SD)
Standard length	42.6–121.9	56.6–88.3	70.7	46.7–75.7
<b>% SL</b>				
Body depth	10.5–15.7 (13.3 ±1.2)	11.9–16.8 (13.9±1.4)	13.7	12.3–16.7 (14.9±1.5)
Head length	19.3–26.3 (22.2±1.6)	19.9–24.4 (21.7±1.2)	21.8	20.0–23.0 (22.0±0.8)
Pectoral-fin length	13.2–21.5 (17.0±2.2)	15.0–20.3 (17.7±1.4)	20.0	14.8–21.1 (18.5±1.9)
Dorsal-fin length	16.2–22.8 (19.2±1.6)	18.1–22.0 (19.2±0.9)	18.1	17.6–21.2 (19.4±1.2)
Pelvic-fin length	11.7–17.8 (14.2±1.1)	12.7–17.8 (14.8±1.2)	14.7	12.6–16.5 (14.9±1.2)
Anal-fin length	11.6–19.9 (15.6±1.5)	13.6–19.0 (15.3±1.1)	13.8	13.8–17.9 (15.2±1.1)
Caudal-fin length	15.7–22.8 (19.0±1.5)	16.4–21.1 (18.3±1.2)	18.0	13.5–21.0 (18.7±1.9)
Caudal-peduncle length	14.6–20.5 (17.3±1.1)	14.2–18.8 (16.6±1.1)	17.6	14.8–18.8 (17.1±1.0)
Caudal-peduncle height	7.2–10.4 (8.7±0.9)	7.4–9.7 (8.4±0.5)	7.4	6.3–9.1 (7.5±0.8)
Caudal-peduncle width	3.5–5.5 (4.4±0.5)	3.0–5.9 (4.2±0.7)	4.8	3.8–5.5 (4.5±0.5)
Prepectoral length	18.2–29.8 (22.7±2.1)	20.7–25.5 (22.6±1.2)	22.0	20.2–25.3 (22.6±1.5)
Predorsal length	50.1–56.9 (53.3±1.7)	51.5–60.0 (54.7±1.8)	53.5	52.4–56.5 (53.7±1.2)
Prepelvic length	49.9–56.0 (52.1±1.7)	50.8–58.4 (53.8±1.9)	53.4	48.2–53.6 (51.6±1.5)
Preanal length	64.9–78.1 (74.1±2.0)	72.4–80.1 (75.8±1.6)	74	71.3–75.8 (73.4±1.3)
Pectoral-pelvic distance	24.0–36.6 (31.1±2.1)	27.8–37.9 (32.9±2.1)	30.3	28.3–31.7 (30.4±1.1)
Pectoral-anal distance	43.8–58.4 (53.0±2.5)	51.5–59.1 (54.9±1.8)	52.2	50.7–54.1 (52.8±1.1)
Pelvic-anal distance	20.1–25.5 (22.7±1.2)	20.0–25.1 (23.0±1.4)	24.1	21.0–24.1 (22.8±1.1)
<b>% HL</b>				
Head height	40.1–51.2 (46.4±2.8)	45.5–53.2 (49.3±2.1)	44.0	40.2–49.6 (45.3± 3.0)
Snout length	38.2–48.1 (44.2±2.0)	41.7–49.1 (44.5±2.0)	39.6	37.6–44.5 (41.6±2.0)
Inner rostral-barbel length	12.4–26.8 (20.2±2.7)	15.0–24.3 (19.4±2.2)	19.0	12.2–21.4 (17.9±2.6)
Outer rostral-barbel length	23.0–32.1 (28.7±2.3)	22.0–33.0 (28.8±2.8)	29.7	23.1–32.9 (27.9±2.7)
Maxillary rostral-barbel length	24.1–32.2 (29.1±2.3)	23.8–34.2 (28.7±2.7)	31.2	26.3–34.0 (29.4±2.6)
Eye diameter	15.1–20.9 (17.6±1.5)	16.0–22.5 (18.8±1.6)	14.8	13.2–17.3 (16.2±1.2)
Postorbital length	37.6–46.9 (42.6±2.1)	36.8–44.6 (40.7±2.0)	45.3	39.7–49.3 (45.3±2.6)
Interorbital length	18.3–28.4 (23.5±2.1)	18.0–27.0 (22.9±2.1)	24.4	19.7–29.3 (24.9±2.9)

Lateral line complete, running slightly below middle of flank anterior to posterior end of anal-fin base, and then along middle of caudal peduncle. Supraorbital canal uninterrupted, not confluent with infraorbital canal; occipital canal continuous, confluent with infraorbital canal. Count of pores in cephalic sensory canal system: 7–8 in supraorbital canal, 12–13 in infraorbital, 3 in occipital, 8–10 in preoperculomandibular, and 60–69 in lateral line.

Fins flexible; D. iii, 7; P. i, 10–11; V. i, 6–7; A. iii, 5; C. 7–8+8 = 15–16 branched rays. Dorsal fin with a slightly concave distal margin, origin nearer to caudal-fin base than to tip of snout, last unbranched ray thickened near base. Pectoral fin inserted immediately anterior to vertical through posteriormost point of operculum, adpressed fin reaching nearly halfway to pelvic-fin insertion. Pelvic fin positioned opposite to dorsal-fin origin, adpressed fin not reaching anus. Anal fin with a straight distal margin. Caudal fin emarginated, its upper lobe as long as lower one. Vertebral count 40–42

Intestine forming a zigzag loop anteriorly, not touching U-shaped stomach. Gas bladder bipartite; anterior chamber fully enclosed in dumbbell-like capsule and posterior chamber strongly reduced.

**Coloration in preservative.** Back and side of body brownish, ventral body grayish. Five or six transverse brown bars on predorsal region of body, and four or five on postdorsal region. Spots scattered over lateral body, and on pectoral and pelvic fins. Spots scattered over dorsal and caudal fins, forming three black lines.

**Sexual dimorphism.** Males with broadened and widened unbranched rays and 4–5 outer branched rays of pectoral fin. Dorsal surfaces of pectoral fins covered with breeding tubercles; breeding tubercles sparsely scattered over head and body in males.

**Distribution.** Currently known from Dali-Nur Lake in Hexigten Banner, Inner Mongolia Autonomous Region (Fig. 4).

**Etymology.** The specific epithet is made from the Latin words ‘*gibbus*’ (humped), referring to the greatly convex predorsal profile of the body.

**Remarks.** We had no access to specimens of these species outside China: *B. compressirostris* (or *B. golubtsovi*), *B. dgebuadzei*, and *B. sawadai*. The first one was resurrected by Kottelat (2006) as a valid species closely related to *B. golubtsovi*. According to Kottelat, *B. compressirostris* differs from *B. golubtsovi* only in the absence of projections on the skin of the body (vs. presence). For facilitating the description of this new species, we tentatively consider *B. compressirostris* and *B. golubtsovi* as the same species. The data used here for the aforementioned species and *B. potaninorum* are from Prokofiev (2004).

*Barbatula potaninorum* was originally described in *Orthrias* by Prokofiev (2007) from North China. Its exact type locality remains unclear. The original description stated that the type specimen was collected by the Russian explorer G. N. Potanin in 1887 from Gansu Province and nearby Inner Mongolia bordering with Mongolia, or the upper Xilingol River in Inner Mongolia. However, his figure 23 indicated that the type locality was Gaxun-Nur Lake in Inner Mongolia. Potanin made two expeditions to China: the first one from 1884–1886, and the second one from 1892–1893. The maps of these two expeditions were provided by Wang (1993) (see Luo 2005: pp. 202 and 205). In April 1886, Potanin traveled west to Qinghai Lake, turned to the north, and, through several ridges, got to the sources of the Zhoshuy River (today’s Hei-He). Then, he followed this river down to Gaxun-Nur Lake in Inner Mongolia. His expedition finally came to the Orkhon River, Kiakhta, Mongolia, in November 1886. If the type material of *B. potaninorum* was caught in 1887, it was not from Gaxun-Nur Lake, and Potanin was not the collector. The material was more likely captured from the upper Xilingol River basin in Inner Mongolia. According to Wang (1993), the Russian military officer E. Harnack made an expedition to Xing’an Mountains, Northeast China, in 1887 (Luo 2003). His expedition started from Peking, turned northeast at Kalgan (today’s Zhangjiakou City), and arrived at Donlon (Inner Mongolia); from there, they headed north to Dali-Nur Lake, which is south of the upper Xilingol River, and eventually entered into Xing’an Mountains. The possibility that the type specimen of *B. potaninorum* was collected by E. Harnack from the upper Xilingol River nearby the Dali-Nur cannot be ruled out.

According to the original description, *B. potaninorum* possesses a scaled body, pelvic fins anterior to the vertical through the dorsal-fin origin, and widely separated nostrils. These characters are shared with *Nemacheilus pechiliensis* Fowler 1899, a species tentatively considered to be a synonym of *B. toni* in this study. The type locality of this species is the Tan Lan Ho, a tributary of the Shu Lan Ho (in the Luan-He basin), around 30 miles northeast of Lama-Miau or Dolon-Nor), Pechili Province, northern China. It is not too far away from the upper Xilingol River basin. Whether *B. potaninorum* and *Nemacheilus pechiliensis* are the same species remain uncertain. This hypothesis needs testing based on examination on the type material of the former and additional specimens from the type locality of the latter. For the time being, *B. potaninorum* is regarded as valid.

### Key to Chinese species of *Barbatula*

- 1a. Anterior and posterior nostrils widely separated. . . . . 2
- 1b. Anterior and posterior nostrils closely placed. . . . . 4
- 2a. Six branched dorsal-fin rays . . . . . *B. potaninorum*
- 2b. Seven branched dorsal-fin rays . . . . . 3
- 3a. Predorsal body scaled . . . . . *B. toni*
- 3b. Predorsal body scaleless . . . . . *B. gibba*
- 4a. Upper lip with a marked median incision; vertebral count 40–42 . . . . . *B. nuda*
- 4b. Upper lip with a slight median incision; vertebral count 44–45 . . . . . *B. altayensis*

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